

## CHAPTER IX. IMPROVING CARE DURING LABOR AND DELIVERY

This chapter contains three sections, each of which addresses aspects of medical care received by mothers and infants during labor and delivery. The first section discusses 39 cases in which the Review identified issues regarding care during labor and delivery. The second describes fifteen cases whose cause of death was perinatal asphyxia (inadequate oxygen supply to the fetus around the time of birth) and explores issues related to fetal monitoring during labor. Of these fifteen cases, eight were also included in the discussion of labor and delivery management cases in the first section. In the last section, we reviewed cases where perinatal infection either contributed to or caused the infant death.

Information on these cases is presented in both statistical summaries as well as illustrative vignettes. The vignettes are based on a compilation of several cases and do not describe any single case. The names used in the vignettes are not those of cases.

Each of these three sections contains conclusions and recommendations based on information from the Review, a review of relevant medical literature and the consensus of the expert opinions of the Technical Review and Obstetrical Care Subcommittee members. A draft of these findings and recommendations was reviewed by representatives of the major hospitals in King County and other clinicians (nurses, midwives, family practitioners, pediatricians and obstetricians) involved in the management of labor, delivery and care of newborns. Comments received from the reviewers were considered by the Obstetrical Subcommittee before finalizing these recommendations.

Each case was reviewed by both the Technical Review Committee and a more specialized Obstetrical Care Subcommittee. This subcommittee included:

- Perinatologists
- Obstetrician/Gynecologists
- Geneticists
- Midwives
- Family Practitioners
- Epidemiologists
- Pediatricians
- Nurses and other Health Department staff.

## OVERVIEW OF CASES WITH ISSUES REGARDING CARE DURING LABOR AND DELIVERY

Of 247<sup>a</sup> cases examined by the Infant Mortality Review between 1992 to 1994, 39<sup>b</sup> (16%) involved issues concerning the medical management of labor and delivery. Two broad categories of issues emerged: those related to the care of the mother and fetus during labor and those pertaining to the care of the newborn immediately following birth. Issues arising before birth included:

- delay in cesarean section
- inadequate fetal assessment during labor
- delay in diagnosis of fetal distress
- delay in maternal transport
- inappropriate indications for procedures.

Concerns related to the immediate care of the newborn included delays in pediatric care and questions regarding techniques used in resuscitating sick infants. Table 1 summarizes these issues, which will be described in more detail below.

**TABLE 9.1**  
**OBSTETRICAL AND NEONATAL CARE ISSUES(N=39 CASES)**

Description of Issue	Number of Cases*
<b>Labor and Delivery Management</b> Delay in c-section, Inappropriate indication for procedures (i.e. forceps), Delay in diagnosis of fetal distress, Inadequate intrapartum fetal assessment	13
<b>Maternal Transfer &amp; Level of Care</b>	6
<b>Other Aspects of Pregnancy Management</b> GBS prophylaxis, Lack of herpes cultures, Poor patient-provider communication	14
<b>Delay in Pediatric Care</b> Delay in arrival of pediatric care provider, Delay in notifying pediatric care provider of the need for attendance at delivery	4
<b>Neonatal Care Issues</b> Prolonged esophageal intubation, Non-standard of care protocols, Failure to suction below cords	13
* EACH CASE CAN INVOLVE MORE THAN ONE ISSUE	

The 39 cases were more likely to be of African American race and not to have graduated from high school when compared to all women giving birth in King County between 1991 to 1993, but did not differ in age, marital status or source of payment for hospital care. The cases were also more likely to be born to mothers having higher numbers of prior births, to be low birthweight and to be born prematurely. In addition, there was no concentration of these cases at any one hospital.

<sup>a</sup> Because there were 68,178 births during this period of time in King County, the cases reviewed in this report comprise only a small fraction of all births.

<sup>b</sup> 39 single births and one twin birth (40 infants)

## MATERNAL TRANSFER & LEVEL OF FACILITY ISSUES

During the course of complicated labors, it is sometimes in the best interest of the mother and fetus to transfer them to a more specialized (“higher level”) hospital for more intensive care. The Review identified six cases in which the transfer was delayed or did not occur. Delay or lack of transfer was considered an issue only if there were no contraindications to transport and there were clear maternal or pediatric indications for care at a higher level facility.<sup>1</sup> The vignette below illustrates several of the issues that were present in the cases reviewed.

**ILLUSTRATIVE VIGNETTE:** Patty, who was 21 at the time, entered a Level I hospital at 31 weeks gestation because of labor contractions. She also had chronic high blood pressure. In the labor and delivery unit, she was found to be in early labor, and an ultrasound confirmed that she was 31 weeks gestation. She was monitored for the next three hours and her labor continued to progress. Plans were made to transfer Patty to a Level II facility, but the labor progressed quickly and an ill infant was delivered with Apgars of 2 and 4<sup>c</sup>. A pediatrician was present at delivery. Thirty minutes later, the neonatologist arrived and made plans to transfer the infant to a Level III hospital. The transport team arrived 90 minutes later and placed the infant on a respirator. The baby was transported to a Level III hospital, where he died three days later.

Several potential factors may have contributed to the delay (or lack of) maternal transport in these cases. In some, when it seemed clear early in the course of labor that moving the mother was indicated so that a potentially sick newborn could be delivered in a higher level facility, the decision to transfer was not addressed until after the labor had progressed too far. A second less common problem was an inappropriate decision made by transport personnel to take the mother to the closest hospital rather than to a higher level facility better suited to care for a potentially ill newborn.

## RECOMMENDATIONS FOR MATERNAL TRANSFER & LEVEL OF FACILITY ISSUES

- Consider transporting a mother in labor promptly if either pediatric or maternal indications for care at a higher level hospital are present.
- Expedite transfer through early communication with staff at the receiving hospital.

## NEONATAL CARE ISSUES

When a sick infant is born, the presence of a pediatric care provider with specialized skills in the care of ill newborns and the provision of appropriate resuscitative care may be important to assure the good health of the infant.<sup>2 3</sup> However, in 13 cases compromised infants were born without the benefit of timely care from a pediatric care provider<sup>d</sup> or they did not receive adequate resuscitation. The following vignette illustrates these concerns:

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<sup>c</sup> “Apgar” scores assess the newborn’s status at one and five minutes after birth. A score of 7-10 signifies good health while a score of 0-2 indicates severe compromise.

<sup>d</sup> In this report, we use the term pediatric care provider to mean a health care provider trained in pediatric resuscitation and newborn care such as a pediatrician, many family practitioners or neonatologists.

**ILLUSTRATIVE VIGNETTE:** Charlene, a mother of four, came into the labor and delivery room suite for induction of labor<sup>e</sup> because she was past her delivery date. When the fetal monitor started to show a lowered fetal heart rate (decelerations), the obstetrician was paged. Charlene's labor continued for several hours until her membranes ruptured, revealing meconium-stained fluid. The fetal heart monitoring strip also revealed fetal distress and the decision was made to proceed with a rapid delivery by cesarean section. During preparations for surgery, a neonatologist was called but did not arrive until one hour later. Charlene's infant was ill at delivery. As no neonatologist was present, the anesthesiologist attempted intubation in the next few minutes but was unsuccessful. The baby died of respiratory complications the following day.

In each of these cases, indications for pediatric support were present at least thirty minutes prior to delivery. There were two common causes for delay in the arrival of pediatric support. In some instances, the pediatricians involved appeared to be given adequate notification but failed to arrive in a timely fashion; in others, obstetrical providers delayed summoning the pediatric care provider. Finally, in other cases, the time at which pediatric support was requested was not documented in the medical records, making it difficult to determine what caused the delay in the arrival of the pediatric care provider.

Another common issue which emerged in thirteen of these 39 cases was the appropriateness of the resuscitation procedures<sup>f</sup> performed on very sick infants. Examples of questionable management included lack of fluid resuscitation and prolonged esophageal intubation. In ten of these thirteen cases, the questionable care received on the labor floor did not appear to contribute to the infant death. These cases will be discussed in more detail in a subsequent report on neonatal and pediatric care.

#### **RECOMMENDATIONS FOR NEONATAL CARE ISSUES**

Increase timely communication among obstetrical, pediatric and nursing providers in clinical situations that might require pediatric back-up:

- Emphasize early communication between pediatric and obstetrical care providers
- Increase awareness among staff of the desired time interval between the summoning and arrival of pediatric support for deliveries at each hospital handling deliveries
- Consider using a "quick check list" of medical staff to be notified in case of fetal distress to assure that all members of the team are summoned in a timely fashion. Consider including possible 'back-up' staff who could be notified if a first call provider were unavailable.

#### **LABOR & DELIVERY MANAGEMENT ISSUES - INTRAPARTUM FETAL DISTRESS**

Fifteen of the infant deaths considered by the Review between 1992 to 1995 were attributed to perinatal asphyxia. These cases have been reviewed by both the Technical Review and the Obstetrical Care Subcommittee. In addition to standard Infant Mortality Review examination of the medical records, the fetal monitoring strips were examined in detail in 14 of the 15 cases. In some cases, there was limited documentation of fetal monitoring by both nurses and physicians. Our recommendations are based both on the documentation and the lack thereof.

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<sup>e</sup> "Induction of labor" refers to medical treatment to initiate and sustain labor in a pregnant woman.

<sup>f</sup> Resuscitation procedures refer to techniques used to support infants with difficulties breathing or circulating blood to essential body organs.

The diagnosis of perinatal asphyxia was based on the four American College of Pediatrics and American College of Obstetrics and Gynecology criteria:<sup>4 5 6 7</sup>

- Evidence of neonatal end-organ dysfunction
- Neurologic dysfunction
- Apgar scores of three or less beyond five minutes
- Umbilical cord acidemia<sup>g</sup> of less than pH 7.2

If one of the four pieces of information was not known, then the diagnosis was confirmed if the other criteria were met and the clinical scenario was consistent with perinatal asphyxia. Umbilical cord gases were not performed<sup>h</sup> in many (9 out of 15) cases and this was the most frequently absent piece of information.

For the most part, these cases involved uncomplicated term pregnancies in white women who had good prenatal care. No individual hospital or obstetrical provider was associated with a disproportionate number of cases. Selected features of these cases are listed in Table 6.2. Infants dying from asphyxia were more likely to be born prematurely and by cesarean section.

**TABLE 9.2**  
**CHARACTERISTICS OF ASPHYXIA CASES COMPARED WITH ALL KING COUNTY BIRTHS**

Characteristic	Asphyxia Cases(%) N=15	All King County Births*(%) N=68,178
<b>Gestational Age at Birth</b>		
Less than 37 weeks	3(20)	4,733(7)
37-41 weeks	12(80)	60,957(93)
Unknown	0	2,488
<b>Mode of Delivery</b>		
Vaginal	9(60) <sup>+</sup>	51,514(82)
Cesarean Section	6(40) <sup>^</sup>	11,220(18)
Unknown	0	5,444
<b>Race</b>		
White	13(87)	49,705(77)
African-American	1(6)	4,510(7)
Other	0	10,661(16)
Unknown	1(6)	3302
* 1991-1993 KING COUNTY BIRTHS		
<sup>^</sup> ALL SIX CESAREAN SECTIONS WERE EMERGENT		
<sup>+</sup> 7 VERTEX AND 2 BREECH DELIVERIES		

Three of these infant deaths were attributable to unpreventable maternal-fetal hemorrhages which were undetected prior to labor. In twelve cases, however, the review committees raised concerns about the adequacy of fetal monitoring during labor or the responses to signs of fetal distress detected through such monitoring. The following two vignettes are representative of these cases.

<sup>g</sup> A high level of acid ("acidemia") in the infant's blood indicates inadequate oxygen supply to the infant

<sup>h</sup> Umbilical cord gases were either not performed or performed at a time too distant from delivery to be used in establishing the diagnosis of perinatal asphyxia.

**ILLUSTRATIVE VIGNETTE:** Sandy was admitted in active labor at term to the facility where she had received comprehensive and uncomplicated prenatal care. Electronic external fetal monitoring was used intermittently. The fetal heart tracing was initially reassuring but later developed intermittent late decelerations with decreased variability and repeated episodes of moderate and severe bradycardia (which are signs of potential fetal compromise). The nursing and medical staff made minimal documentation of their assessment of the baby during labor. After a 3 1/2 hour labor, Sandy gave birth to a 3400 gram (7 1/2 pounds) baby with Apgars of zero and one. Although no pediatrician was present at delivery, one arrived within a few minutes. The baby died two days later with the diagnosis of asphyxia.

This vignette illustrates several patterns which recurred in these cases. First, all but one of these pregnancies appeared uncomplicated until labor. Second, in eleven of the fifteen cases, fetal assessment or monitoring appeared inadequate given the clinical circumstances. For example, despite indications of possible fetal distress, intermittent external fetal monitoring was used when a fetal scalp electrode would have provided better fetal assessment. In addition, fetal monitoring was often intermittent (rather than continuous) despite worrisome fetal heart tracings.<sup>8</sup>

In ten cases, there also appeared to be a clinically significant delay in the diagnosis of fetal distress. The Review diagnosed fetal distress by the combination of clinical parameters (e.g. thick meconium) and significant abnormalities in the fetal heart tracing<sup>i</sup>. In several cases it was not clear if the nursing and medical staff recognized these signs of potential fetal distress.

Finally, documentation by the staff of fetal status (e.g. recording of the interpretation of fetal heart tracings) was often inadequate in these cases. In several cases, neither the nursing nor medical staff medical record notes address the persistence of fetal tachycardia and/or recurrent late decelerations on the fetal heart tracing (both signs of potential fetal compromise).

**ILLUSTRATIVE VIGNETTE:** The births of Anna's several other children had all been normal. This pregnancy was uneventful and included 12 prenatal visits. At term, she noticed her baby's movement had decreased and she was seen in clinic the following morning. A fetal heart tracing was non-reactive (which is abnormal) and she was admitted to Labor and Delivery where external fetal monitoring revealed fetal distress. An emergency cesarean section was performed well within 30 minutes of her arrival to the labor floor. A neonatologist was present at delivery and assigned Apgars of one, two and four at one, five and ten minutes after birth, respectively. The infant died four days later with a diagnosis of asphyxia and meconium aspiration. Thorough documentation was present regarding both maternal, fetal and pediatric care.

It is important to remember that asphyxia can occur despite the best obstetrical care, as the above vignette illustrates. In four of the fifteen cases reviewed, death from asphyxia occurred despite obstetrical care that met or exceeded treatment standards.<sup>9 10 11</sup> These tragedies highlight the need for continued research into the etiology and detection of intrauterine fetal distress.

<sup>i</sup> e.g. decreased variability with either fetal tachycardia [heart rate greater than or equal to 170 beats per minute] or recurrent late decelerations

## **RECOMMENDATIONS FOR LABOR AND DELIVERY MANAGEMENT: MANAGING INTRAPARTUM FETAL DISTRESS**

Management of possible intrapartum fetal distress<sup>j</sup> remains a challenging issue. The review of these fifteen cases of perinatal asphyxia raised three main concerns:

- Delay in response to indications of fetal compromise during labor
- Delay in notification of obstetrical providers by nursing staff of an abnormal fetal heart tracing
- Lack of documentation of interpretation of fetal status during labor and of care provided in response to indications of fetal distress.

We suggest that the following measures will contribute to improved outcomes for distressed fetuses during labor and delivery:

- Increase efforts that will assure thorough communication among the team of providers that cares for women during labor and delivery. In these cases described above, there were several areas where communication appeared to breakdown:
  - ◆ Among staff during transfer of care and change of shift
  - ◆ Between nurses and obstetrical providers during labor regarding the fetal heart strips
  - ◆ Between pediatric and obstetrical care providers during complicated labors
- Encourage hospitals and birth centers to adopt standardized guidelines or establish institution-specific guidelines, if they have not already done so, for:
  - ◆ Nursing staff to contact obstetrical care providers regarding fetal heart strips
  - ◆ Obstetrical providers to contact obstetrical and pediatric back-up as appropriate
- Promote regular professional education about fetal monitoring, signs of fetal compromise and methods of fetal assessment and resuscitation during labor by encouraging hospitals, birth centers and professional associations to provide obstetrical providers and nursing staff with continuing education and updated guidelines.
- Encourage hospitals and birth centers to concentrate quality improvement programs on:
  - ◆ Adequate communication among providers during labor and delivery
  - ◆ Fetal monitoring guidelines for both nurses and obstetrical care providers
  - ◆ Adequate documentation of care provided by nursing and obstetrical providers during labor
- Increase efforts by providers to educate pregnant women about the signs and symptoms of fetal compromise such as lack of fetal movement.

## **INFANT DEATHS CAUSED BY INFECTIONS**

Perinatal infection was noted as the underlying cause of death in 12 of the 247 cases of infant death examined by the Review. Four deaths were attributable to disseminated Herpes Simplex Virus II (HSV) infection, four to Group B Strep (GBS) sepsis (bacterial invasion of the body), three to sepsis caused by other organisms, and one to a congenital viral syndrome. Those caused by HSV and GBS are discussed in more detail in the following sections of this chapter.

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<sup>j</sup> Intrapartum fetal distress refers to compromise of the fetus during labor and delivery.

The mothers of infants who died of these infections were more likely to be young, to have at least one prior birth, to be African American or Native American, to live in low income households and to deliver prematurely than all mothers in King County.(see Table B.31 in Appendix B).

In twenty other infant deaths, infection was judged to be an important factor contributing to death but not the underlying cause of death<sup>k</sup>. Eighteen of these were deaths due to complications of prematurity in which chorioamnionitis (infection of the placental membranes) was identified as having contributed to the premature birth. In most instances, no specific cause (etiologic agent) of the chorioamnionitis was identified. These cases will be addressed in a future report on infant deaths related to prematurity.

### HERPES SIMPLEX VIRUS INFECTION (HSV)

In the four cases of death due to neonatal HSV, none of the mothers had a known history of genital HSV<sup>l</sup>. HSV was considered as a diagnosis in only one case, when a maternal herpes lesion was noted at the time of delivery. In the three unrecognized cases, the mother presented with a significant fever (102 °F or greater) during or just prior to labor and a low or normal white blood cell count. Maternal evaluation for bacterial infection, including blood, urine and amniotic fluid cultures, was negative. All four patients had clinical and/or pathological evidence of chorioamnionitis. The majority of deliveries were by cesarean section, occurring between 3 and 20 hours after rupture of membranes. Infants became ill between zero and thirteen days after delivery. Diagnoses were made by cultures from each infant.

ILLUSTRATIVE VIGNETTE: Rosa, a young woman who had been pregnant three times and given birth twice, found herself pregnant again as a result of unprotected sex. She had a history of multiple sexual partners and had been treated twice in the past for a sexually transmitted disease but she had no history of genital herpes. During her pregnancy she had sporadic prenatal care. At 38½ weeks gestation she felt like she had the flu. When her membranes ruptured she went to the hospital. On admission she had a fever of 102°. Her white blood cell count was 5000 cell/mm<sup>3</sup>, and antibiotic therapy was initiated. Urine and blood cultures were done and subsequently returned negative. Her labor failed to progress, so the baby was delivered by cesarean section. Rosa's baby weighed 3300 grams (7½ pounds) and was discharged with her mother three days after birth. He was well until the fifth day of life when he began to feed poorly and suffered a seizure. He was readmitted to the hospital and treated with antibiotics for presumed sepsis. Acyclovir was later added after results of nasopharyngeal culture were positive. Despite treatment, Rosa's baby died of overwhelming herpes simplex virus infection.

It is now known that the infants at greatest risk for significant neonatal HSV infection are those born to mothers with a primary infection during pregnancy. This is particularly true if the infection occurs at or near term. We know from epidemiological studies that risk factors for HSV include prior or current sexually transmitted diseases, young maternal age, and multiple partners. Although there are insufficient data (i.e. lack of maternal viral serology<sup>m</sup>) in these cases to establish that they were in fact primary maternal HSV infections, the lack of prior history of HSV and the presence of fever suggests that this is likely. The presence of fever in the mother at or near the onset of labor has not previously been described as a risk factor for neonatal HSV infection. A more definitive study would be needed to demonstrate that this sign is indeed a clinically useful predictor of neonatal HSV infection.

<sup>k</sup> The underlying cause of death is the disease or injury which initiated the events resulting in death. For example, the underlying cause of death in an infant born at 28 weeks would be classified as prematurity. If an infection did occur, it would have contributed to the infant's death, but the underlying cause would remain prematurity.

<sup>l</sup> Infants with HSV infection usually acquire the virus during birth when they come into contact with an HSV infection in the mother's birth canal.

<sup>m</sup> blood tests indicating the presence and duration of herpes infection

## **RECOMMENDATIONS FOR HERPES SIMPLEX VIRUS INFECTION**

Recognition and management of maternal and neonatal HSV infections are difficult and guidelines are changing.<sup>12 13</sup> Primary HSV infection should be considered as a possible cause of maternal febrile (fever) illness at or near the onset of labor, particularly if no other cause is identified (including negative amniotic fluid cultures) and the peripheral white blood cell count is low or normal.

For all patients in whom HSV infection is suspected, the following are recommended:

- Careful labial and cervical exam to identify lesions
- Genital HSV cultures using an appropriately "vigorous" technique to obtain samples in order to avoid false negative results
- Notification of the pediatric care provider of the suspicion of maternal HSV infection and of the presence of a maternal genital HSV culture

## **GROUP B STREP INFECTION (GBS)**

There were four cases in which the GBS infection was the underlying cause of death, fewer than expected given the average incidence in the United States.<sup>14</sup> This implies that efforts in King County to reduce perinatal death due to GBS have been partly successful.

However, these four cases demonstrate that additional steps are needed to further reduce the incidence of GBS. In two cases, the mother had vaginal cultures showing GBS infection prior to delivery, while in the two additional cases her GBS status was unknown. Risk factors for invasive neonatal GBS infection (see below) were present in two cases. Intrapartum antibiotic prophylaxis was not given in any of the cases. The committee identified several management issues which may have contributed to the lack of prophylaxis: failure to recognize a risk factor for GBS infection and lack of effective communication between providers about positive GBS cultures or GBS risk factors.

Developing general recommendations for the prevention of GBS infection in neonates has been difficult because of the high (up to 40 percent) rate of colonization in pregnant women and the relatively low incidence (1.5 per 1000 births) of invasive GBS disease in neonates. The intermittent nature of shedding of GBS, the resulting low sensitivity of routine cultures for detecting infection, and the lack of a reliable rapid test for screening women during labor also contribute to this difficulty. Ampicillin or penicillin prophylaxis during labor is known to significantly reduce (although not eliminate) deaths due to GBS, but widespread use raises the problems of creating antibiotic resistance as well as causing illness in mothers from antibiotic reactions.<sup>15 16</sup>

Guidelines aimed at the prevention of neonatal GBS disease have been issued by organizations including the American Academy of Pediatrics,<sup>17</sup> American College of Obstetricians and Gynecologists,<sup>18</sup> and the Centers for Disease Control and Prevention<sup>19</sup>. There is general agreement that risk factors for invasive neonatal GBS infection include the following:

- Preterm birth (<37 weeks)
- Prolonged (12-18 hours) rupture of membranes
- Fever during labor (100° F or greater)
- Previous sibling with invasive GBS
- GBS bacteriuria (indicates heavier vaginal colonization).

The guidelines differ as to advisability and timing of screening cultures, and indications for intrapartum prophylaxis. Antepartum cultures performed late (35-37 weeks) in pregnancy are most predictive of maternal GBS status at term. It is agreed that the use of selective media cultures and simultaneous vaginal and rectal specimens greatly improve the predictability of antepartum cultures. Rapid intrapartum screening by optical immunoassay has much improved sensitivity over previous rapid test methods but it is unclear whether even this newest assay has sufficient sensitivity to replace routine antepartum screening.<sup>20</sup>

Because of the cost and lack of reliability of early testing to predict GBS status at delivery, some advocate doing no cultures and treating all patients that have risk factors. Although the majority of cases of invasive neonatal GBS have evidence of one or more risk factors, a significant minority of cases do not. In this particular sample, two of the four deaths did not have identified risk factors. One of these was known to be GBS positive, and the other might have been identified as a GBS carrier had testing been done. Intrapartum prophylaxis may have prevented these deaths. The benefit of treating all mothers with positive GBS cultures must be weighed against the problems of serious reactions (e.g. anaphylactic shock) to antibiotic therapy and development of antibiotic-resistant organisms.<sup>15 21</sup> Despite these uncertainties, the recent Center for Disease Control (CDC) recommendations suggest treatment of all mothers with positive GBS cultures.

### **RECOMMENDATIONS TO PREVENT NEONATAL GBS INFECTION**

Because management of GBS infection remains an area of controversy, we cannot recommend one specific strategy for prevention of neonatal GBS disease. However, we strongly recommend that providers consider the following:

- In-depth discussion with patients concerning the issues involved in screening and prophylaxis of GBS
- Treatment of all patients with risk factors, regardless of GBS status.
- Treatment of all mothers with positive GBS cultures, regardless of gestational age or other risk factors.
- Adoption and adherence to site-specific screening protocols by all providers. Factors to consider in developing such protocols include:
  - ◆ Using selective media cultures and obtaining simultaneous vaginal and rectal specimens when screening cultures are performed
  - ◆ Formalizing a system for communicating both pending cultures and culture results to labor and delivery staff and all other providers involved in caring for the mother and newborn
  - ◆ Establishing a system to verify that treatment has been carried out for all positive cultures.

### **CONCLUSIONS**

In summary, the Review revealed that in several important areas, efforts in King County to reduce perinatal deaths have been successful. We also observed that perinatal asphyxia and other poor outcomes can occur despite the best obstetrical and pediatric care.

Although in many of the cases reviewed, the care provided met or exceeded the standard of care in this region, the Review process revealed several areas of concern. For example, we identified cases in which labor management strayed substantially from practice guidelines established by the American College of Obstetricians and Gynecologists and the American Academy of Pediatrics.<sup>2</sup> The departure from recommended practice may have contributed to fetal compromise in several of these cases. On the

other hand, it is likely that care often varies from these guidelines without adverse consequences, and how often this variation occurs is not known. This is an important area for further investigation. Despite this uncertainty, it seems reasonable to meet certain standards for obstetrical and pediatric care, such as the prompt diagnosis and treatment of fetal distress and adequate communication among the team of health professionals providing care during labor and delivery.

To further these goals, we have developed recommendations for improving obstetrical care in King County in four major areas, based on the findings of the Review:

- Maternal transfer and level of delivery facility
- Labor and delivery management issues concerning fetal monitoring and possible fetal compromise
- Perinatal infections
- Neonatal care immediately following birth

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